Tax Changes and Asset Pricing

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Abstract

This paper investigates whether investors were compensated for the tax burden of equity securities over the time period between 1913 and 2006. Effective tax rates on equity securities vary over time due to changes in tax rates on dividends and capital gains and due to changes in corporate payout policies. Effective tax rates also vary cross-sectionally due to persistent differences in propensities to pay dividends, which tend to be taxed more heavily than capital gains. The results indicate an economically plausible and statistically significant tax capitalization over time and cross-sectionally.

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I Introduction

Taxes have an important impact on effective asset returns for taxable investors. Asset valuations and asset returns should reflect this tax burden in equilibrium. To compensate taxable investors for their tax burden, before-tax asset returns should be higher and asset valuations should be lower in periods of relatively high tax rates. Furthermore, assets facing higher tax burdens, such as stocks paying highly taxed dividends, should offer higher risk-adjusted returns, as derived by Brennan (1970). However, taxes should not affect asset valuations and asset returns if investors can effectively eliminate their tax burden on equity securities, as discussed by Miller and Scholes (1978). This study investigates empirically whether equity valuations and before-tax equity returns are related to their effective tax burdens using a new data set covering personal tax burdens between 1913 and 2006.

The effective tax burdens on equity securities vary substantially over time and cross-sectionally. I compute effective personal tax rates on equity securities following Poterba (1987b). The aggregate tax burden on equity securities has declined over the last decades as tax reforms reduced the statutory tax rates on dividends and capital gains and as the opportunities to invest in tax-qualified environments such as pensions and tax-deferred retirement accounts were expanded. In addition, corporations replaced a significant fraction of relatively highly taxed dividends with share repurchases. Besides the time-series variation in tax burdens, there is also a significant cross-sectional variation in tax burdens. Due to differences in the taxation of dividends and capital gains, stocks that distribute a larger fraction of their total returns as dividends tend to be taxed more heavily than stocks that distribute a smaller fraction of dividends. Dividend paying stocks faced, on average, an effective tax rate that is more than three times higher than the effective tax rate of non-dividend paying stocks.

To investigate whether equity prices are affected by taxes, I perform two empirical tests. The first test investigates whether effective tax burdens are related to aggregate equity valuation levels over the period between 1913 and 2006. Aggregate equity valuations should be relatively low during time periods of high taxes to compensate taxable investors for their tax burdens. Consistent with this tax capitalization hypothesis, I find an economically and statistically significant negative relationship between equity valuations and effective tax rates.

The second test uses the time-series and the cross-sectional variation in tax burdens to determine whether the average returns of different equity securities depend on their tax burden. Brennan (1970) shows that high dividend yield stocks should exhibit higher risk-adjusted returns if dividends are taxed at a higher rate than capital gains. This cross-sectional dividend yield effect should be particularly pronounced in time periods where dividends are highly taxed. I find that risk-adjusted returns of U.S. common stocks over the period between 1927 and 2006 are positively related to their effective tax rates. The impact of taxes on asset returns is economically and statistically significant and remains robust over several sub-periods, using various measures of the effective tax rate, and using different econometric specifications.

These results are consistent with McGrattan and Prescott (2005), who derive the quantitative impact of tax and regulatory changes on equity values using a growth theory model. They show that these regulatory changes can explain the large secular movements in corporate equity values relative to GDP. McGrattan and Prescott (2005) base their inferences on a carefully calibrated growth model. However, they do not perform an econometric analysis of the relationship between tax rates and asset valuations and they do not study cross-sectional variations in tax burdens.

Over the last several decades, the empirical effect of personal dividend and capital gains taxes on stock prices and stock returns has received a lot of attention in the finance, economics, and accounting literatures.[1] Research papers have investigated whether div-

[1]See Auerbach (2002), Poterba (2002), Allen and Michaely (2003), and Graham (2003) for literature reviews.

idend yields are related to stock returns[2], whether the ex-dividend day price behavior is caused by tax effects[3], and whether individual tax reforms have an impact on asset valuations[4]. Despite the numerous papers in this area, Graham (2003) argues that "the profession has made only modest progress documenting whether investor taxes affect asset prices" (p. 1120). My paper sheds light on this tax capitalization controversy by taking into account the substantial time-series variation in effective tax rates on equity securities.

An influential literature in public economics has investigated the impact of dividend tax changes on economic activity. Under the "traditional" view dividend taxes affect the marginal source of finance, while under the "new" view developed by King (1977), Auerbach (1979), and Bradford (1981) dividend taxes have no impact on the investment incentives of firms using retentions as marginal source of funds. Although my paper does not directly test the implications of the two views, the theoretical model and the empirical results are broadly consistent with the "new view."

The paper is structured as follows: Section II summarizes the major tax reforms between 1913 and 2006 and derives the historical effective tax rates on asset returns over this period. Section III reports the time-series results, investigating whether there is a systematic relationship between the effective tax rate and aggregate equity valuations. Section IV reports the results of the empirical test investigating whether there is a relationship between average asset returns and effective tax rates based on the cross-sectional variation in dividend yields. Section V concludes.

[2]See, for example, Brennan (1970), Black and Scholes (1974), Litzenberger and Ramaswamy (1979, 1980, 1982), Blume (1980), Gordon and Bradford (1980), Miller and Scholes (1982), Auerbach and King (1982, 1983), Poterba and Summers (1984), Keim (1985), Chen, Grundy, and Stambaugh (1990), Bossaerts and Dammon (1994), Naranjo, Nimalendran, and Ryngaert (1998), Kalay and Michaely (2000), Dhaliwal, Li, and Trezevant (2003), and Dhaliwal, Krull, Li, and Moser (2005).

[3]See, for example, Elton and Gruber (1970), Kalay (1982), Eades, Hess, and Kim (1984, 1994), Barclay (1987), Michaely (1991) Bali and Hite (1998), Frank and Jagannathan (1998), Green and Rydqvist (1999), Graham, Michaely, and Roberts (2003), Elton, Gruber, and Blake (2005), and Chetty, Rosenberg, and Saez (2007).

[4]See, for example, Guenther (1994), Lang and Shackelford (2000), Ayers, Cloyd, and Robinson (2002), Auerbach and Hassett (2005), and Dai, Maydew, Shackelford, and Zhang (2006).

II Effective Tax Rates

This section derives effective tax rates on equity securities over the period between 1913 and 2006.

A Definition of the Tax Burden on Equity Securities

The effective tax burden of equity securities depends on the statutory tax rates and on the management style of the stock portfolio. The effective taxes on an equity portfolio can be reduced by holding stocks with low dividend yields, by deferring the realization of capital gains or accelerating the realization of capital losses, and by holding a larger proportion of the assets in tax-qualified environments (for example, pensions and tax-deferred retirement accounts).

The expected taxes paid on a portfolio depend first on the marginal dividend tax rate τ_k^{DIV} and on the marginal short- and long-term capital gains tax rate rates τ_k^{SCG} and τ_k^{LCG}. Second, the composition of the sources of income from equity investments has also an important impact on the tax burden of a portfolio. Whereas expected dividend income $DIV_{k,t}$ is taxed at the dividend tax rate, anticipated short- and long-term capital gains realizations $SCG_{k,t}$ and $LCG_{k,t}$ are taxed at the corresponding capital gains tax rates. The expected taxes on portfolio k at time t equal:

$$T_{k,t} = \tau_t^{DIV} DIV_{k,t} + \tau_t^{SCG} SCG_{k,t} + \tau_t^{LCG} LCG_{k,t}. \tag{1}$$

The expected tax yield $\kappa_{k,t}$ is defined as the proportion of the value of the portfolio k in the previous year that is anticipated to be taxed in the current year t:

$$\begin{aligned}\kappa_{k,t} = \frac{T_{k,t}}{V_{k,t-1}} &= \frac{\tau_t^{DIV} DIV_{k,t} + \tau_t^{SCG} SCG_{k,t} + \tau_t^{LCG} LCG_{k,t}}{V_{k,t-1}} \\ &= \tau_t^{DIV} y_{k,t}^{DIV} + \tau_t^{SCG} y_{k,t}^{SCG} + \tau_t^{LCG} y_{k,t}^{LCG}. \end{aligned} \tag{2}$$

The anticipated dividend yield y^{DIV} is defined as the expected taxable dividends divided by the initial value of the portfolio. Similarly, the expected short- and long-term capital gains yields y^{SCG} and y^{LCG} are defined as the proportions of the portfolio values that are anticipated to be realized either as short- or long-term capital gains. The remainder of this section explains in more detail how these variables were constructed.

Section III usees the tax yield for the Standard & Poor's Composite Index whereas Section IV uses the tax yield for stock portfolios formed according to the dividend yield.

B Dividend and Capital Gains Tax Rates

Marginal statutory tax rates on dividend and long-term capital gains income have fluctuated considerably, as shown in Figure 1. The figures show the statutory federal marginal dividend and long-term capital gains tax rates for households in three different real income brackets. The two lower income brackets correspond to real income levels of \$100,000 and \$250,000 expressed in 2006 consumer prices. The third bracket corresponds to the marginal tax rate for the top income bracket. Generally, dividend taxes are considerably higher and more volatile than long-term capital gains tax rates. For example, the top federal dividend tax rate has been as high as 94 percent in 1944 and 1945. The marginal short-term capital gains tax rates are very similar to the marginal dividend tax rates except for the period after the 2003 tax reforms. The construction of the time series is explained in more detail in Appendix A.

To compute the average tax rates on dividends and capital gains for taxable investors, I follow Poterba (1987b) and construct dollar-weighted average tax rates for dividends τ^{DIV} and short- and long-term capital gains τ^{SCG} and τ^{LCG}. Since 1917, the Internal Revenue Service publishes the distribution of income sources of taxpayers in different income brackets. The marginal tax rate can be determined for each of these income brackets. The value-weighted mean of the marginal tax rates of investors in the different income brackets is called the "average marginal tax rate." This tax rate will represent the average tax burden of taxable investors in various tax brackets. Prior to 1965, I hand-collected tax distribution data from different issues of the Statistics of Income of the IRS. Since 1965, the NBER publishes the average marginal tax rates on an annual basis. Additional details on the construction of the dividend and capital gains tax rates are summarized in Appendix B. Figure 2 depicts the average marginal tax rates of dividends and long-term capital gains for equities held by taxable investors. The average marginal tax rate on realized long-term capital gains is generally less than the average marginal dividend tax.

The expansion of various types of tax-qualified pension and retirement accounts has resulted in a substantial decline in the proportion of stocks held by taxable investors. The proportion of corporate equity held by taxable investors decreased from more than 90 percent in the 1950s to less than 50 percent in 2006 according to the Flow of Funds published by the Board of Governors of the Federal Reserve. This dramatic decline is primarily due to the increased importance of pension funds, tax-deferred retirement accounts, and nonprofit organizations. Equity securities held in tax-qualified accounts or by tax-exempt institutions are assumed to face zero dividend and capital gains taxes. The overall tax burdens including both taxable and tax-exempt investors are therefore computed as the proportion of equities held by taxable investors multiplied by the average marginal tax rates of taxable investors.[5]

C Dividends and Capital Gains Realizations

The sources of investment income for equity securities varied considerably over the sample. Dividend income was the dominant source of income for stock holders during most of the period. In the 1980s and 1990s, dividend yields decreased substantially as companies

[5]Dividends and capital gains realizations of stocks held in tax-qualified retirement accounts are tax-exempt. On the other hand, contributions to tax-deferred accounts are tax-deductible and withdrawals from tax-deferred accounts are taxed at the ordinary income tax rates. If households remain in the same tax bracket over their life time, then the deductibility of contributions and the taxation of withdrawals exactly offset each other.

retained a larger proportion of their earnings and as they increased share repurchases. This change in payout behavior of corporations was at least partially triggered by regulatory changes that eased share repurchases.[6]

The computation of the effective tax yield as described in equation (2) requires the anticipated dividend yield y^{DIV}, which is not observable. Since dividend payout policies are persistent over time, I assume in the base case that the anticipated dividend yield of each portfolio equals the actual dividend yield paid during the prior 12 months. This definition ensures that the dividend yield is strictly based on past data and is not affected by informational biases as described by Miller and Scholes (1982). Robustness tests analyze the impact of using alternative anticipated dividend yields.

Whereas the dividend distributions are relatively straight-forward, it is more difficult to estimate anticipated capital gains distributions. The computation of capital gains yields takes into account that capital gains realizations tend to be smaller for companies that pay higher dividend yields. As describe in more detail in Appendix D, I assume that investors anticipate to realize a fixed proportion of expected capital appreciation (i.e., expected return minus expected dividend yield). The fixed proportion of short- and long-term capital gains realizations is based on the average propensities to realize capital gains over the whole sample period according to the Internal Revenue Service.

The average short- and long-term capital gains yields over the whole sample period are 0.12 percent and 1.80 percent of the aggregate market value. The capital gains yields are relatively small compared to the average capital gains for several reasons. First, the realization of capital gains can be deferred indefinitely. The deferral of the realization of capital gains is beneficial because the present value of the tax liabilities decreases if the tax payments are postponed. Second, the taxation of capital gains can be avoided completely due to the "step-up of the cost basis" at the time of death, which eliminates

[6]The SEC adopted Rule 10b-18 in 1982, which provides a safe-harbor for repurchasing firms against the anti-manipulative provisions of the Securities Exchange Act of 1934. See Allen and Michaely (2003) for additional details.

the taxation of all unrealized capital gains. Third, investors can avoid capital gains taxes by contributing their shares to a charitable organization. Finally, tax evasion is more prevalent for capital gains realizations than for dividends. Robustness tests reported in the paper document that the results are not affected qualitatively using alternative capital gains realization behaviors.[7]

D Effective Tax Yield

The empirical part of this paper relates the effective tax yield to the aggregate equity valuations and to equity returns of various portfolios. Figure 3 summarizes the effective tax yield of different equity portfolios. The middle curve shows the effective tax yields using the Standard & Poor's Composite Index between 1913 and 2006. The top and the bottom curves correspond to the tax yields of common stocks from the CRSP database between 1927 and 2006 which either did not pay any dividends in the prior year or were in top dividend-yield quintile. Stocks paying high dividend yields tend to have substantially higher and more volatile effective tax rates than non-dividend paying stocks. The cross-sectional variation in tax yields is described in more detail in Section IV.

Due to data limitations it is necessary to make several simplifying assumptions about the equity holdings of investors. In particular, it is not possible to observe the identify of the investors. This could be problematic since clientele effects might induce highly taxed investors to avoid high dividend yield stocks.[8] Furthermore, corporations might

[7]The assumption that only a fraction of the total capital gains are realized results in a lower effective tax rate on capital gains, as discussed by Bailey (1969), Feldstein, Slemrod, and Yitzhaki (1980), and Poterba (1987a). This assumption implicitly takes into account the present value of future tax liabilities. My estimation method results in a ratio between the effective accrual rate of capital gains and the statutory rate of 26.6 percent, which is very close to the 25 percent used by Poterba (1987b). However, this capital gains realization behavior is more tax-efficient than the implied valuations of capital gains taxes from Green and Hollifield (2003) and Chay, Choi, and Pontiff (2006). Poterba (1987a), Ivkovich, Poterba, and Weisbenner (2005), and Jin (2006) analyze the capital gains realization behavior of individual and institutional investors.

[8]For example, Allen, Bernardo, and Welch (2000) and Baker and Wurgler (2004) discuss why firms might pay dividends. Grinstein and Michaely (2005), Graham and Kumar (2006), and Dahlquist, Robertsson, and Rydqvist (2006) find some evidence of tax clienteles. However, the tax clienteles effects are not sufficiently strong to completely eliminate taxes on investment income. Brav, Graham,

also adjust their payout policies depending on their clienteles. Thus, the derived effective tax rate might be a noisy measure for the tax rate of the marginal investor. However, measurement error in the effective tax rate should bias the results against finding an impact of taxes on asset returns. In several robustness tests, I show that the tax capitalization results are qualitatively unaffected using alternative assumptions for computing effective tax rates.

III Time-Series Evidence

This section studies the time-series relationship between effective tax rates and aggregate equity valuations. The tax capitalization hypothesis implies that higher tax rates are associated with lower equity valuations.

A Macroeconomic Data

Table 1 lists summary statistics for the data. The detailed data sources and definitions are listed in Appendix G. The first row summarizes the moments of the effective tax yield. Rows (2) to (4) summarize the average marginal tax rates on dividends and long-term capital gains for taxable investors and Rows (5) to (7) summarize the marginal statutory tax rates from the federal government for three different income brackets, corresponding to real income levels of $100,000, $250,000, and the maximum income bracket. The tax variables differ in their levels, but they are generally highly correlated with the exception of the average marginal tax rate on long-term capital gains. Row (8) summarizes the proportion of equity that is held by taxable investors according to the Federal Reserve Board's Flow of Funds. The dividend yield is defined as the dividend payments over the current year divided by the price level of the S&P Composite Index at the end of the prior year. The dividend yield varies significantly over time and ranges

Harvey, and Michaely (2005) document that tax considerations are secondary for financial executives when deciding on payout policies.

between 1.1 (2000) and 8.9 percent (1950).

The empirical tests use two measures of the aggregate valuation levels of U.S. equities summarized in rows (10) and (11). The first measure is the equity Q, which is defined as the market value of equities divided by the book equity value of equity based on Wright (2004) between 1900 and 1951 and the Federal Reserve Board's Flow of Funds Accounts between 1952 and 2006. The second measure of the aggregate equity valuation is the price-earnings ratio, which is defined as the S&P index level at the end of the year divided by the earnings in the subsequent year. The price-earnings ratio in the regressions is divided by 100 for expositional purposes. The equity Q exhibits a correlation with the price-earnings ratio of 63 percent.[9]

Table 1 also summarizes the moments of various macroeconomic variables. The return of the S&P Composite Index is computed by adding the S&P Composite dividend payments in the current year to the corresponding end-of-year price index and dividing by the price index at the end of the prior year. The interest rate corresponds to the compounded annual return of 6-month corporate yields. The inflation rate is computed as the growth rate in the Consumer Price Index. The per capita growth rate is defined as the growth rate of aggregate domestic output divided by the U.S. population.

To capture time-varying risk premia, I use the corporate bond quality spread (i.e., the yield difference between long-term Baa and Aaa corporate bonds) and the corporate bond term spread (i.e., the yield difference between long-term Aaa bonds and the compounded annual return of 6-month corporate interest rates).

Stock participation is estimated as the total number of tax returns with dividend income according to the Internal Revenue Service divided by the total number of households. This number likely underestimates the equity participation rate since households

[9]Since the valuation ratios are persistent, it is important to test whether they follow unit roots. Dickey-Fuller tests for unit roots in the equity Q and the price-earnings ratios can be rejected at the ten and the one percent levels, respectively. A regression of the difference in the equity Q (price-earnings ratio) on the corresponding lagged values have coefficients of -0.138 (-0.252) with standard errors of 0.053 (0.070). In the subsequent estimations, I will take into account the autocorrelation of the dependent variables by computing Newey-West standard errors.

owning non-dividend paying stocks are not captured in the Statistics of Income and since some households that own stocks might not file taxes. The latter bias is particularly significant prior to 1945 when a significant fraction of low and medium income households were not required to file taxes. Therefore, the stock participation rate will only be considered after 1945. The stock participation rate has increased gradually from around 8 percent in the late 1940s to 32.6 percent in 2000.

To separate the impact of government policies through taxes and expenditures, I compute the ratio between government expenditures and aggregate domestic output.

The finance literature has reported a positive correlation between equity valuations and merger activity. Although it is not completely clear whether merger activity causes high valuations or whether high valuations cause merger activity, some specifications control for merger waves. The standardized M&A activity is defined as the aggregate number of M&A transactions divided by the number of companies according to the Statistics of Income. Following Town (1992) the fraction of M&A transactions is standardized by subtracting the mean and dividing by the standard deviation of the spliced time-series. The standardized M&A activity has a correlation of 39 percent with the price-earnings ratio and the equity Q.

Two final control variables are the top marginal federal corporate tax rate based on IRS data and an indicator variable for whether the current president is a member of the Democratic party. Both variables are positively related to the effective tax rate.

B Regression Specification

In this section, I discuss the relationship between taxes and equity valuations. The relationship between asset valuations and effective taxes is estimated using the following regression equation:

$$val_t = \alpha_0 + \alpha_1 \kappa_t + \alpha_2 rf_t + \alpha_3 \pi_t + \alpha_4 t + \epsilon_t. \tag{3}$$

The base case specification uses two proxies for equity valuation levels: the equity Q and the price-earnings ratio. The independent variables in the base case are measured in the current year: The effective tax yield is denoted by κ_t; the short-term interest rate by rf_t; the inflation rate by π_t; the nominal per capita growth rate by g_t; and the linear time trend by t.

If taxes are capitalized into asset prices, then the tax coefficient α_1 should be negative. The level of interest rates might have an impact on asset valuations, since stocks and fixed-income securities are alternative investment options. As interest rates increase, stock valuations should decline as long as risk premia remain unaffected. The inflation rate and the per-capita growth rate might capture time-varying risk premia as time periods of high inflation and low growth tend to be periods with high uncertainty and high equity premia. Thus, equity valuations might be lower with high inflation and low growth rates. However, such times of low growth and high inflation might also be time periods where earnings are temporarily low, resulting in an ambiguous effect on the price-earnings ratio. Several robustness tests introduce additional control variables and demonstrate that the tax effect remains important under alternative specifications.

C Regression Estimates

Table 2 reports a significantly negative relationship between tax yields and equity valuation levels both before and after controlling for macroeconomic control variables. The standard errors follow Newey and West (1987), where the autocorrelation structure is estimated using a four-year lag.[10]

The results on the tax coefficient are both economically and statistically significant. For example, the multi-variate analysis indicates that a one-standard deviation increase in the effective tax yield reduces the equity Q by 0.16 (-20.727×0.008) or by 53 percent

[10] The Newey-West standard errors are significantly higher than the OLS standard errors. For example, the OLS standard errors of the tax variables in multivariate specifications of Table 2 would have been only 3.323 and 0.869 instead of 3.960 and 1.162, respectively. However, increasing the number of lags beyond four does not further increase the standard errors.

of the standard deviation of the equity Q. Similarly, a one-standard deviation increase in the effective tax yield reduces the price-earnings ratio by 2.5 ($-3.154 \times 0.008 \times 100$) or by 35 percent of the standard deviation of the price-earnings ratio. The interest rate and the inflation rate also have an important impact on asset valuations. A one standard deviation increase in the interest rate decreases the equity Q by 0.084 or by about 27 percent of the standard deviation of the equity Q, whereas a one standard deviation increase in the inflation rate reduces the equity Q by 0.054 or by about 17 percent of the standard deviation of the equity Q. The growth rate does not have a significant impact on asset valuation levels and has opposite signs for the two different valuation ratios.[11] Finally, both asset valuation proxies have a positive time trend over the sample period.

D Robustness Tests

This section tests for the robustness of the previously described results using different sub-periods, additional control variables, and different tax rates.

D.1 Subperiod Results

Table 3 divides the sample period into two roughly equal subperiods. The relationship between effective tax yields and equity valuations is negative for both valuation ratios and in both subperiods. Whereas the relationship is stronger in the first half of the sample for the equity Q ratio, it is stronger in the second half of the sample for the price-earnings ratio.

The sample period can be extended to a regime without personal federal income taxes by including the period prior to 1913. Data on equity Q is available since 1900 and data on the price-earnings ratio can be used after the Civil War taxes were repealed in 1872. During this period prior to 1913, the effective tax yield on equity is set equal to zero. Unreported results indicate that extending the estimation window over this regime

[11] Similarly, an indicator variable for NBER recessions does not have significant explanatory power for equity valuation ratios and is excluded for brevity.

without taxes increases the magnitude and the statistical significance of the coefficient on the effective tax rate in both specifications. For example, the tax yield coefficients (and the corresponding standard errors) equal -24.929 (4.171) using the equity Q and -3.507 (1.062) using the price-earnings ratio.

One concern is that the high valuation levels in the late 1990s could explain the relationship between taxes and valuation levels. Excluding the time period after 1994 does not have a significant impact on the results. For example, using the equity Q as the dependent variable the tax yield coefficient equals -20.727 (3.960) over the whole sample period and -19.072 (2.462) between 1913 and 1994. Similarly, the coefficient on the tax yield using the price-earnings ratio equals -3.154 (1.162) over the whole sample period and -2.042 (0.869) between 1913-1994.

D.2 Additional Control Variables

Table 4 documents that the relationship between taxes and asset valuation levels remains unaffected after introducing additional control variables. Panel A uses the equity Q and Panel B the price-earnings ratio as the dependent variable.

The first two control variables are proxies for time-varying risk-premia. Both the quality and the term spreads of corporate bonds are negatively related to equity valuation levels, indicating that equity values are lower in periods where bond spreads are larger. The results are economically very significant, as a one percentage point increase in the quality spread between Baa and Aaa bonds reduces the equity Q by 0.17 or by approximately 25 percent.

The stock participation measure in the overall population is a proxy for the risk-perceptions of investors.[12] Investors are more likely to overcome fixed participation costs in equity markets if they are relatively risk-tolerant or if they perceive risks to be relatively low compared to the expected equity premium. The relationship between

[12]See Mankiw and Zeldes (1991) and Vissing-Jørgensen (2002) for a discussion of limited asset market participation.

equity valuations and stock participation is positive using both valuation measures. However, the results are not statistically significant due to the relatively short availability of the stock participation rate.

The effective tax yield in the base-case specification could proxy for the impact of government expenditures instead of taxes. To investigate this hypothesis, I add the current government expenditures relative to aggregate domestic output as an additional control variable. Government expenditures do not have a significant impact on equity valuations and adding this control variable does not significantly affect the coefficient on the tax variable.

Mergers and acquisitions occur in waves which are related to aggregate valuation levels as summarized by Town (1992) and Andrade, Mitchell, and Stafford (2001). This positive relationship is confirmed in my sample. However, adding this control variable does not affect the tax coefficient substantially. Furthermore, it is not clear whether valuation levels cause M&A activity or whether M&A activity cause valuation levels.

Both personal investment taxes and corporate taxes should affect asset prices in equilibrium. However, the impact of corporate taxes on the relative valuation levels used here should be secondary compared to the impact of personal taxes because the valuations ratios are computed by normalizing the price levels by variables that take corporate taxes into account.[13] Over the sample period between 1913 and 2006, the effective personal tax yield on equity securities has a correlation of 51.69 percent with the corporate tax rate. The corporate tax rate does not have a significant relationship with the two valuation measures and adding this control variable does not substantially affect the impact of the effective personal tax yield on equity securities.

Tax rates on equity securities tend to be higher under Democratic administrations.

[13] The earnings used to normalize the price-earnings ratio are computed after subtracting corporate taxes. Therefore, if corporate taxes are constant over time, then both the valuation levels and the earnings levels will be reduced proportionally by the long-term tax rate. On the other hand, the book value used to compute the equity Q ratio includes besides the contributed capital also retained earnings that include the effect of corporate taxes.

To separate tax policies from other policies, I introduce in the last column an indicator variable which depends on whether the president is a Democrat. There is a positive relationship between the two valuation ratios and the indicator variable for Democratic administrations. However, this relationship is only significant using the equity Q variable. Under both specifications, the tax rate remains statistically significant.

The variables in Table 4 are introduced separately since they are available over different periods and since some of the variables are highly correlated. Adding all variables simultaneously decreases the statistical significance of some control variables, however the coefficients on the tax rate remain statistically significant at the 1 percent level for both valuation ratios.

D.3 Instrumental Variable Estimation

The effective tax yield is endogenous since tax policies and dividend distributions policies might depend on the economic environment. To resolve these issues, I use an instrumental variables estimation that controls for autocorrelation in the residuals. The instrument used here for the effective tax rate is the current government expenditures divided by aggregate output. This variable enters the first stage regression of the tax rate with a positive sign that is statistically significant at a one percent confidence level and 50 percent of the variation in tax yields is explained by current government expenditures and the other exogenous variables. On the other hand, as shown in Table 4, the current government expenditures are not significantly related to the valuation level. The regression results using this approach are summarized in the first column of Table 5. The coefficients on the tax rate remain very similar in this alternative specification compared to the specification in Table 2. However, it is important to be cautious when interpreting these results. Government expenditures are not an ideal instrument despite the high correlation with the tax rate and the low correlation with the valuation ratio since government expenditures are not truly exogenous. In the next section, I discuss additional robustness tests that address potential endogeneity issues of dividend yields and capital gains distributions.

D.4 Alternative Tax Measures

The derivation of the effective tax yields requires many specific assumptions. Table 5 investigates the impact of different assumptions of estimating effective tax yields. The second column estimates the tax yield of only taxable investors and ignores the time-series variation in the proportion of equity held in tax-qualified environments. The results are in this case very similar to the base case results.

The third column keeps the dividend and capital gains distribution weights constant over the whole sample period. In this case, the variation in effective tax yields is only driven by the variation of dividend and capital gains tax rates.[14] The coefficients on the tax variables in Panels A and B become slightly less negative but remain statistically significant. For example, the coefficient on the tax yield using the Equity Q valuation ratio changes from -20.727 to -17.552. Thus, variations in dividend yields over time contribute to the tax effect, but they do not completely explain the effect.

While it is relatively straight-forward to estimate dividend distributions on a given portfolio, it is more difficult to estimate expected capital gains realizations. The fourth column assumes that investors never realize any capital gains, whereas the fifth column assumes that investors expect to realize all long-term capital gains annually.[15] The coefficient estimates in these two extreme cases of capital gains realizations do not differ economically or statistically from the base case estimates.

The last three columns use the marginal statutory federal tax rates on dividends and capital gains for investors in three different income brackets corresponding to real income

[14] The effective tax yield equals in this case $\kappa_{k,t} = \tau_t^{DIV}\overline{y}_k^{DIV} + \tau_t^{SCG}\overline{y}_k^{SCG} + \tau_t^{LCG}\overline{y}_t^{LCG} = 0.045 \times \tau_t^{DIV} + 0.001 \times \tau_t^{SCG} + 0.018 \times \tau_t^{LCG}$.

[15] The effective tax yields equal $\kappa_{k,t} = \tau_t^{DIV} y_{k,t}^{DIV}$ in the fourth column and $\kappa_{k,t} = \tau_t^{DIV} y_{k,t}^{DIV} + \tau_t^{cg}(\overline{r}_{k,t} - y_{k,t}^{DIV})$ in the fifth column, where $(\overline{r}_{k,t} - y_{k,t}^{DIV})$ is the expected capital gain and $\tau_t^{cg} = (\overline{y}_k^{SCG}\tau_t^{SCG} + \overline{y}_k^{LCG}\tau_t^{LCG})/(\overline{y}_k^{SCG} + \overline{y}_k^{LCG})$ is the weighted average tax rate on capital gains using the average realized capital gains over the sample period.

levels of \$100,000, \$250,000, and the maximum income levels. Under all three cases, there is a negative relationship between the tax yield and the valuation ratios, which is at least statistically significant at the five percent level. The level of the coefficient estimates differs between the various specifications, since the different tax variables have very different standard deviations, as summarized in Table 1. These results indicate that the results are robust to alternative definitions of the relevant tax rate.

D.5 Alternative Dependent Variables

The relationship between effective tax rates and equity valuation ratios remains qualitatively unaffected if I use alternative measures of valuation ratios besides the equity Q and the price-earnings ratio. To economize on space, the results are just briefly summarized and not reported in tabular form. For example, defining the price-earnings ratio by dividing the end-of-year price of the S&P Index by the earnings in the current year instead of the subsequent year has a very small impact on the coefficients. Furthermore, the results are slightly more statistically significant if the earnings used to compute the price-earnings ratio are averaged over the prior five or ten years to smooth out short-term variations in earnings due to the business cycle, as recommended by Campbell and Shiller (1998). In addition, the results are also robust if the valuation ratio is defined as the ratio between the price of the S&P index and the dividend of the index or as the ratio between the market capitalization of all stocks in the CRSP database divided by the total distributions to shareholders (i.e., dividend payments plus share repurchases).

The tax capitalization hypothesis implies that high tax regimes are associated with relatively low equity valuation levels and with relatively high before-tax equity returns. Consistent with this hypothesis, I find a significantly positive relationship between effective tax rates and nominal returns on the S&P Composite Index before and after controlling for the macroeconomic variables given in Table 2. The coefficient on the effective tax yields equals 4.67 for the univariate regression and 5.16 for the multivariate regression with standard errors of 1.95 and 1.82, respectively. These coefficients imply that a one standard deviation increase in the tax yield increases nominal stock returns by between 3.6 and 4.0 percent.

One issue of any time-series investigation is the limited amount of independent data available. To mitigate these issues, the following section analyzes the cross-sectional variation in tax burdens. These cross-sectional results confirm the hypothesis that taxes have an impact on equity prices.

IV Cross-Sectional Evidence

This section analyzes the cross-sectional variation in tax burdens by dividing the stocks traded on the major U.S. stock exchanges between 1927 and 2006 into portfolios according to their lagged dividend yield. The cross-sectional results will be based on returns instead of valuation ratios since the finance literature has developed models to adjust cross-sectionally for risk based on returns, whereas there are no such models for valuation ratios. These panel results confirm the hypothesis that taxes have an impact on abnormal asset returns.

A Empirical Specification

The empirical estimation of the tax effects on equity returns is based on the theoretical model of Brennan (1970), who relates the risk-adjusted stock returns to their dividend yield. To adjust for risk and style effects, abnormal asset returns are computed based on conventional factor pricing models, such as the one-factor CAPM, the three-factor Fama and French (1993) model, and the four-factor Carhart (1997) model. I add the tax yield $\kappa_{k,t}$ to the pricing models to examine its impact on equity returns. The empirical specification of the extended Fama-French-Carhart model is as follows:

$$\begin{aligned} r_{k,t} - r_{f,t} &= \alpha + \beta_{k,t}^{M}(r_{M,t} - r_{F,t}) + \beta_{k,t}^{SMB}(r_{S,t} - r_{B,t}) \\ &\quad + \beta_{k,t}^{HML}(r_{H,t} - r_{L,t}) + \beta_{k,t}^{UMD}(r_{U,t} - r_{D,t}) + \gamma\kappa_{k,t} + \epsilon_{k,t}. \end{aligned} \tag{4}$$

The return of portfolio k during time period t is denoted by $r_{k,t}$. The index M corresponds to the market portfolio and the index F to the risk-free rate. Portfolios of small and large stocks are denoted by S and B; portfolios of stocks with high and low ratios between their book values and their market values are denoted by H and L; and portfolios of stocks with relatively large and small returns during the previous year are denoted by U and D. The Fama-French-Carhart model nests the CAPM model (which includes only the market factor) and the Fama-French model (which includes the size and the book-to-market factors in addition to the market factor).[16] The factor loadings β denote the sensitivities of the returns of a portfolio to the various factors and are estimated for each of the portfolios separately. To allow the factor loadings to change over time, the factor loadings are estimated separately for each 5-year time period.[17]

The tax yield coefficient γ is positive if investors are compensated for the personal taxes by obtaining higher before-tax returns for assets facing higher tax burdens, particularly in periods where taxes are relatively high. A coefficient of one implies that the abnormal return increases exactly by the amount of the tax. However, the coefficient can differ from one because the marginal investor might differ from the average investor used to compute the effective tax yield.

[16]The market, size, book-to-market, momentum factors and the risk-free rate are obtained from Ken French's website (http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/index.html).

[17]For example, a separate $\beta_{k,t}^{M}$ is computed for each portfolio k over 16 non-overlapping time periods $(1927-1930; 1931-1935; ...2001-2006)$. The results of this approach are qualitatively similar to a two-stage approach where the portfolio returns are first adjusted for risk and style using the factor models and the abnormal returns are subsequently regressed on the tax yield.

B Dividend Portfolios

To obtain some cross-sectional variation in the effective tax burdens, I divide the common domestic stocks in the CRSP database into portfolios according to the lagged dividend yield and the lagged market capitalization of publicly traded companies. The portfolio returns are computed using market capitalization weights within each portfolio. The portfolios are formed annually for three sorting criteria. The first criterion forms two portfolios based on whether companies paid taxable dividends in the prior year. The second sorting criterion forms six portfolios based on the lagged one-year dividend yield. One of the six portfolios includes non-dividend paying stocks and the other five portfolios are dividend yield quintile portfolios. The third criterion forms 30 portfolios according to the dividend yield and the size of the underlying stocks. All the common stocks in the CRSP database are first sorted monthly into the six groups based on their lagged one-year dividend yields described above. Subsequently, each of the six dividend yield groups is further divided into quintile portfolios according to the lagged market capitalization. The cutoff levels for the market capitalizations of the quintile portfolios are based only on the distribution of the market capitalization on the NYSE to avoid significant changes in the portfolio composition when NASDAQ stocks were included in the CRSP database. The portfolios are formed at the end of June of each year. If a stock gets delisted after the initial portfolio formation, then the weights of the remaining stocks are adjusted proportionally. The composition of the portfolios is kept constant over a year to obtain consistent rebalancing frequencies with the factor returns used to adjust the portfolio returns for risk and style.

The first two columns of Table 6 show the current and the future dividend yields for the various portfolios. Although dividend yields revert towards the mean, dividend payments are relatively persistent at the portfolio level. This justifies using the prior dividend yield as the expected value of the future dividend yield.

Based on these assumptions, it is possible to derive effective tax yields for different portfolios according to equation (2). Figure 3 summarizes the variation of expected tax yields for the S&P 500 Composite Index, for stocks that did not pay any taxable dividends in the prior year (bottom curve), and for the 20 percent of dividend paying stocks with the highest dividend yields in the prior year (top curve). The effective tax yield of dividend paying stocks is substantially larger and more volatile than the effective tax yield of non-dividend paying stocks. The difference in tax burdens is particularly pronounced in the 1940s and 1950s and in the late 1970s.

Since high-dividend yield stocks are taxed relatively heavily, abnormal equity returns should be relatively high for these stocks. The three last columns of Table 6 summarize the abnormal returns of the portfolios. The abnormal returns α are computed over the whole sample using the conventional factor regressions from equation (4) excluding the tax yield factor $\gamma\kappa_{k,t}$. The table lists the averages of the time-series of these monthly abnormal returns over the period between 1927 and 2006. Table 6 demonstrates that stocks paying high dividend yields tend to have significantly higher average abnormal returns than stocks paying no dividend yields. For example, stocks in the highest dividend quintile outperform non-dividend paying stocks by between 21 and 42 basis points per month using the various factor adjustments.

Figure 4 depicts the rolling coefficient estimates of the factor loadings based on the Fama-French-Carhart model for the returns of non-dividend paying stocks and top dividend-yield quintile stocks between 1932 and 2006. Non-dividend paying stocks tend to have a higher exposure to the aggregate market and they tend to be smaller stocks. Furthermore, non-dividend paying stocks tend to be value stocks before 1960 and growth stocks after 1960. Non-dividend paying companies in the early part of the sample were often distressed companies with relatively low market values, whereas non-dividend paying companies in the latter part were often young companies with favorable growth prospects. Due to this significant variation in the factor loadings, it is crucial to estimate time-varying factor loadings.

Figure 5 depicts the cross-sectional relationship between average annualized abnormal returns and the average annualized tax yield for the 30 dividend/size portfolios over the whole sample period. For each of the 30 portfolios, I compute the abnormal returns for the one-, three-, and four-factor models using time-varying factor loadings as discussed previously. The figures show a positive relationship between average tax yields and average equity returns regardless of the risk-adjustment method. This result shows that there is a robust cross-sectional relationship between tax yields and risk-adjusted stock returns even after aggregating all observations over time and ignoring the time-series variation in tax burdens.

C Tax Capitalization Regression

The following results take full advantage of the time-series variation in effective tax rates and estimate regression equation (4) including the tax yield coefficient. Table 7 summarizes the tax yield coefficients γ for the three different portfolio classifications and for the three risk-adjustment methods. The regressions have 1908, 5724, and 28,620 observations for the three different portfolio classifications. Since the panel data set exhibits significant cross-sectional correlation, I use clustered standard errors by time to adjust for the cross-sectional correlation.

The tax yield coefficient γ is significantly different from zero in all specifications. The coefficient estimates are more statistically significant adjusting for the Fama-French-Carhart common factors and using a richer portfolio classification.[18] A tax yield coefficient of one implies that the abnormal return increases exactly by the amount of the tax. The coefficient estimates are generally not statistically significantly different from one, indicating that the tax effect is economically plausible. For example, a coefficient of 0.73 for the Fama-French-Carhart model implies that if the tax yield increases by one

[18] Adjusting the returns by introducing the liquidity factor of Pastor and Stambaugh (2003) in addition to the four Fama-French-Carhart factors does not affect the qualitative results of the paper for the period between 1966 and 2004, when the liquidity factor is available. The liquidity factor is obtained from WRDS (http://wrds.wharton.upenn.edu/).

percentage point, then the abnormal return increases by 0.73 percentage points. The remainder of this section reports various robustness tests using the 30 portfolios formed according to size and dividend yield. The results are qualitatively similar for the other portfolios.

D Time-Series Variation of Tax Premia

To investigate whether a trading strategy based on tax burdens is profitable, I plot in Figure 6 the yearly abnormal return spread against the tax yield differential between dividend paying stocks and non-dividend paying stocks. The abnormal returns are computed using the four-factor model of Fama-French-Carhart, as described in equation (4) but without controlling for the tax yield variable. Panel A depicts the difference between dividend paying and non-dividend paying stocks whereas Panel B depicts the difference between the top dividend yield quintile and non-dividend paying stocks.

The tax capitalization hypothesis makes three predictions about the relationship between return spreads and tax differentials: First, highly taxed stocks should have a higher average return than less highly taxed stocks. Second, the return spread should be higher in periods where the tax differential is larger. And third, the return spread should be zero if there is no tax differential between the different portfolios.

Figure 6 confirms the three predictions of tax capitalization. First, highly taxed securities tend to pay significantly higher returns than less highly taxed securities. The mean return spread in Panel A equals 2.07 percent per year (indicated by the dashed horizontal line) with a standard error of 0.77 percent. The corresponding return spread in Panel B equals 2.03 percent per year with a standard error of 1.16 percent. Thus, dividend paying stocks tend to compensate taxable investors by paying higher abnormal returns. Second, the slopes of the solid regression lines are significantly positive and equal 3.22 and 2.05 with standard errors of 1.17 and 0.87 for Panels A and B, respectively. The slopes of the regression lines are based on the time-series variation in tax differentials.

Third, the intercepts are close to zero, indicating that the abnormal return spread would be zero if all equity securities were taxed symmetrically.

Although there is a positive relationship between tax yield differentials and abnormal return spreads, there remains a significant amount of variation in the return differentials. Thus, taxes can only explain a small fraction of the time-series variation in return spreads using annual data. This result is comforting, otherwise it would be puzzling why tax-neutral arbitrageurs would not immediately take advantage of the return differential by going long highly taxed stocks and going short less highly taxed stocks. The existence of such arbitrageurs would likely eliminate the return differential between the two groups of securities. The fact that taxes have an impact on asset returns implies that there are important limits to arbitrage as discussed by Pontiff (1996), Shleifer and Vishny (1997), and Fama and French (2007). There are several frictions that prevent investors from taking advantage of the before-tax return differentials. First, significant risk remains in a long-term trading strategy that buys high-dividend stocks and shorts non-dividend paying stocks as shown in Figure 6. The significant residual risk decreases the incentives for tax-neutral arbitrageurs to eliminate these price discrepancies. Second, tax arbitrage can cause trading costs that reduce the return of any strategy that generates high turnover.

E Robustness Tests

This section investigates the robustness of the cross-sectional results using alternative tax measures or alternative estimation methodologies.

E.1 Subperiod Evidence

Table 8 reports the tax capitalization coefficients γ from equation (4) for four different subperiods using the 30 dividend/size portfolios. The majority of the coefficient estimates are significantly positive. The tax yield coefficient measures the impact of a fixed change in the tax yield. Whereas the tax yield coefficient is relatively stable over the whole sample period, the standard deviation of the tax yield has decreased dramatically over time. For example, the cross-sectional standard deviation in the monthly tax yield ranges between 0.16 percent in 1943 and 0.02 percent in 2006. Thus, the overall impact of taxes on asset returns has decreased over time.

The coefficient estimates tend to be relatively large in the last two subperiods, time periods where the aggregate tax burden on equity securities decreased substantially. An unexpected reduction in the dividend tax rate results in larger returns of stocks paying high dividends compared to stocks paying low dividends generating relatively high tax yield coefficients. On the other hand, the standard errors are also high during this time period, resulting in insignificant estimates for the subperiod between 1990 and 2006.

E.2 Different Effective Tax Rate

To construct the effective tax rate, it is necessary to make some simplifying assumptions. This section shows that the results are robust to alternative definitions of the effective tax rate. The first row of Table 9 simply repeats the base case results from Table 7 for comparison. In the base case, the anticipated dividend yield is set equal to the lagged actual dividend yield. This assumption can bias the results due to the mean reversion of the dividend yields as shown in Table 6. To avoid any biases, I use the fitted value of a partial adjustment model as the anticipated dividend yield. In the partial adjustment model, the future dividend yield of portfolio k is regressed on the lagged dividend yield of the corresponding stock portfolio and on the lagged dividend yield of the market portfolio. This partial adjustment model allows for persistence in the dividend yield and for a reversion of the dividend yield toward the aggregate market yield. Row (2) of Table 9 shows that the results are not substantially different using the fitted dividend yield based on the partial adjustment model.

In the base case, the effective tax rate is computed by averaging the tax burdens over taxable and tax-qualified investors. Row (3) excludes assets held in tax-deferred accounts and computes the tax yield coefficient for taxable investors only. This change in the tax yield increases that tax yield coefficients slightly.

The base case specification assumes that all stock portfolios have the same expected returns when computing the effective tax yields, as explained in Appendix D. Row (4) uses the actual average returns of the stock portfolios to compute their effective tax yields and indicates that the returns are not affected much by this alternative assumption. However, this assumption could result in a spurious relationship between abnormal equity returns and effective tax rates since stocks with higher mean returns tend to have higher capital gains realizations and higher effective tax yields. The results indicate that the magnitude of this potential spurious correlation is second order.

Investors might not have access to all the available information on current tax rates and income distributions at the beginning of the year. Furthermore, tax rates are endogenous and might depend on the stock market performance during a particular year. Row (5) uses the 12-month lagged tax yield as the explanatory variable. The positive relationship between tax yields and risk-adjusted returns remains intact.

The base case assumes that investors anticipate to realize a fixed proportion of their capital gains every year and to defer the remaining gains. The sixth and seventh rows investigate whether different assumptions on the capital gains realization behavior affect the results. The sixth row assumes that investors completely avoid realizing any capital gains and the seventh row assumes that investors do not defer capital gains and expect to realize all capital gains annually. The coefficient estimates are only marginally different from the base case, indicating that the results are driven primarily by dividend taxes and not by capital gains taxes.

The base case assumes that the marginal investor faces a tax rate on dividends and capital gains equal to the tax rate of the average investor. Rows (8) to (10) use instead three different federal statutory tax brackets on dividend income and short- and long-term capital gains to compute the tax yield. The tax yield coefficients under these three alternative tax yields are all significantly positive. Whereas the tax capitalization coefficients are around one for the $100,000 income bracket, they are significantly smaller than one for the top tax bracket. This result is consistent with the marginal investor having an intermediate tax bracket.

Row (11) includes a time-fixed effect for each month in the regression. Since this captures a clustering effect by month, the standard errors in this specification are clustered by portfolio number. This time-fixed effect controls for macroeconomic variables that affect all asset portfolios symmetrically and vary over time. Using all three factor models, I find a significantly positive effect of the tax yield variable.

V Conclusions

The paper sheds new light on the controversy of whether taxes are capitalized into asset prices taking advantage of both the cross-sectional and the time-series variation in tax burdens. The effective personal taxation of equity securities fluctuated considerably between 1913-2006. I find that aggregate valuation levels are related to measures of the aggregate personal tax burden on equity securities. Furthermore, stocks paying a large proportion of their total returns as dividends face significantly higher tax burdens than stocks paying no dividends. The results indicate that there is an economically and statistically significant relationship between before-tax abnormal asset returns and effective tax rates. Stocks that tend to have higher tax burdens tend to compensate taxable investors by offering higher before-tax returns.

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A Data

This section explains in detail the exact data sources and the computations used to derive the effective tax rate.

A Statutory Tax Rates

Taxable income is derived for three real income levels expressed after deducting exemptions for a married couple filing jointly with two dependent children from the fixed income levels. The proportion of total deductions relative to the adjusted gross income is assumed to equal the proportion of total deductions in the whole population for each year as reported by the Internal Revenue Service. The marginal income tax brackets and exemptions are determined using the Statistics of Income of the Internal Revenue Service for the years 1913-1943, Pechman (1987) for the years 1944-1987, and different issues of the Instructions to Form 1040 from the IRS for the remaining years between 1988-2006. The values of the Consumer Price Index are taken from the Bureau of Labor Statistics.[19] Total deductions as a proportion of adjusted gross income (AGI) are derived from different issues of the Statistics of Income of the IRS. Marginal income tax rates for individuals in two different tax brackets corresponding to Adjusted Gross Income levels of $100,000 and $250,000 (with 2006 consumer prices), as well as the highest marginal income tax rate are derived. To determine the statutory tax rates, I convert the real income levels into nominal income levels using the Consumer Price Index.

The long-term capital gains tax rate applies to realized gains with a holding period of more than five years. The data source for the capital gains tax rates for 1927-1950 is the Synopsis of Federal Tax Laws from the Statistics of Income for 1950. The remaining tax rates are taken from different issues of the General Explanations of Tax Legislation by the Joint Committee on Taxation (1988-1998) and Table 2-4 from Burman (1999).

B Average Marginal Tax Rates

The time series for the average marginal tax rates of dividends and short- and long-term capital gains are hand-collected using different annual issues of the Statistics of Income between 1917 and 1964 and the average marginal tax rates from the National Bureau of Economic Research between 1965-2006. The IRS did not publish information on the dividend and capital gains distributions between 1913 and 1916. I assume that the income distribution in these years is identical to the published income distribution in 1917. Data after 2003 is derived from the 2000 Tax Model, since these years are not yet available from the Statistics of Income of the IRS. However, the data includes the tax changes through August 2007. The NBER publishes average marginal tax rates for selected income sources since 1960 using their Taxsim software.[20]

[19] Data can be found at http://www.bls.gov/cpi/home.htm.

[20] I thank Dan Feenberg for computing some of these time series specifically for this project. Additional information on this microsimulation model can be found in Feenberg and Coutts (1993). The time series can be downloaded from http://www.nber.org/~taxsim.

The NBER publishes average marginal tax rates including state and local taxes since 1979. For the early data, I use the data from the Bureau of the Census and from the National Income and Product Accounts published by the Bureau of Economic Analysis (BEA) to determine the state and local tax rates. The Bureau of the Census publishes for selected years since 1922 the individual income taxes from state and local institutions.[21] I use these time series until 1940 to compute the ratio between local and state taxes and federal taxes. For missing years, I impute the state taxes using nearby years. These imputations for missing years should not affect the results much since state and local personal income taxes were relatively small early in the 20th century. After 1940, I use data from the BEA, which summarizes the current personal income tax receipts of state and local governments (Table 3.3) and the federal government (Table 3.2).[22]

I assume that the state and local government tax rate on dividends and capital gains is a fixed proportion of the federal tax rate based on the ratio of the state income tax revenues $T_{state,t}$ relative to federal income tax revenues $T_{federal,t}$. To take into account that states might have differences in the taxation of investment income relative to other income, I also assume that the relative tax rate of state and local governments on dividends and capital gains prior to 1979 is proportional to the relative tax rate of state and local governments in 1979 (the first year where NBER computed the state and local taxes on dividends and capital gains). Thus, the tax rate on dividends (and similarly for short- and long-term capital gains) at the state level prior to 1979 is computed as follows:

$$\tau^{DIV}_{state,t} = \tau^{DIV}_{federal,t} \frac{T_{state,t}}{T_{federal,t}} \left(\frac{\tau^{DIV}_{state,1979} / \tau^{DIV}_{federal,1979}}{T_{state,1979} / T_{federal,1979}} \right) \tag{5}$$

The average imputed tax rate on state taxes on dividends is 7.02 percent of the federal tax rate on dividends. Furthermore, the results in this paper are not affected if state taxes are completely left out and the effective tax rate is just computed for federal taxes, since the two effective tax rates have a correlation coefficient of 99.77 percent.

C Tax-Exempt Equities

Equity securities held in tax-qualified accounts or by tax-exempt institutions are assumed to face zero dividend and capital gains taxes. The proportion of equity held in taxable accounts is estimated using the Flow of Funds published by the Board of Governors of the Federal Reserve System.[23] The proportion is only computed for equities held by domestic investors, since it is impossible to determine the marginal tax rates faced by international stock investors. The Flow of Funds publishes this distribution of equity holdings only between 1945 and 2006. The values prior to 1945 are taken from the most recent available year.

Households effectively only own a fraction of their tax-deferred assets since the gov-

[21] The data are available in the series Y658 from the Historical Statistics of the United States Colonial Times to 1970, which is available from:
http://www2.census.gov/prod2/statcomp/documents/CT1970p2-12.pdf.

[22] The data can be downloaded from http://www.bea.gov.

[23] The data can be downloaded from http://www.federalreserve.gov/releases/Z1/.

ernment will tax withdrawals at the future ordinary income tax rates. However, the government also taxes the equity held in taxable accounts because of dividend and capital gains taxes. Poterba (2004) investigates the relative valuation levels of equity held in taxable and tax-deferred accounts. He finds that a fixed dollar amount of equity held in a tax-deferred environment can be worth more or less than the same dollar amount of equity held in a taxable environment. Since the inclusion of taxes in the valuation of equity securities in taxable and tax-deferred environments is not unambiguous, I assume in the base case of my paper that one dollar of equity held in a tax-deferred environment is equivalent to one dollar of equity held in a taxable environment. However, the results in the paper are not affected if I assume that one dollar held in a tax-deferred account is only worth $1 - \tau$ dollars in a taxable account, where τ is the average marginal tax rate on ordinary income.

The proportion of tax-qualified equities is computed similarly as McGrattan and Prescott (2005) as the ratio between corporate equity held by domestic tax-qualified investors and the total corporate equity held (Flow of Funds variable FL893064105) minus the total corporate equity held by the rest of the world (FL263064003). The total corporate equity held by tax-qualified domestic investors has three main components: (1) private and public pension plans; (2) Individual Retirement Accounts (IRA); and (3) nonprofits. The pension plan equity holdings consist of the total pension plan equity holdings held directly by private pension plans (FL573064105), by state and local government pension plans (FL223064105), and by federal government pension plans (FL343064105). Furthermore, these pension plans hold equity securities indirectly through pass-through entities such as mutual funds. The Flow of Funds accounts give the holdings of mutual funds held by pension plans (FL573064203 and FL223064203). The equity share of these mutual funds is estimated by dividing the aggregate corporate equity held by mutual funds (FL653064000) by the total assets held by mutual funds (FL653164005). The Flow of Funds gives data on the total assets held in IRAs (FL893131573). However, the Flow of Funds do not indicate which proportion of the IRA holdings are equity holdings. To determine the equity holdings in IRAs, I assume that the proportion of equity held in IRAs equals the overall proportion of equity held by mutual funds. This imputed proportion closely corresponds to the proportion of equity in IRAs from the Survey of Consumer Finances (SCF) conducted every three years between 1989 and 2001. On average, mutual funds held 55 percent equity securities according to the Flow of Funds and households in the SCF held 54 percent equity in their IRAs. Both sources indicate a relatively large increase in the equity holdings over the sample period. Finally, the Flow of Funds publishes the corporate equities (FL163064105) and the mutual funds (FL163064205) held by non-profits between 1987 and 2000. The proportion of equity held by non-profits in mutual funds is again assumed to equal the aggregate proportion of equity held by mutual funds. Using this data, we can compute the proportion of the aggregate equity held by non-profits for these years. For the remaining years with missing data, we impute the equity proportion held by non-profits to equal the average between 1987 and 2000, which was 7.9 percent. The proportion of equity held by non-profits in these years is relatively stable and ranges between 6.7 and 9.4 percent.

D Aggregate Capital Gains Yields

The annual Statistics of Income of the Internal Revenue Service report between 1917 and 2004 the total short- and long-term capital gains and the dividends declared by individuals. The capital gains given by the Statistics of Income include capital gains from many sources and not just from stock transactions. The IRS does unfortunately not report every year the proportion of capital gains that result from transactions of corporate equities. However, for eight years between 1959 and 2004, the IRS reports the sources of capital gains in more detail. On average, about 35 percent of the capital gains result from transactions of corporate equity. I interpolate the fraction of stock capital gains using these eight years.

The IRS reports the dollar amount of dividends $D_{IRS,t}$ and short- and long-term capital gains $SCG_{IRS,t}$ and $LCG_{IRS,t}$ declared on tax forms. However, the IRS does not report the value of the total taxable assets. I compute the actual short- and long-term capital gains yields $y^{SCG}_{IRS,t}$ and $y^{LCG}_{IRS,t}$, by multiplying the value-weighted dividend yield $y^{DIV}_{M,t}$ of the aggregate stock market (either S&P Composite Index or CRSP value-weighted index) with the ratio between the short- and long-term realized capital gains $SCG_{IRS,t}$ and $LCG_{IRS,t}$ divided by the total dividend payments $D_{IRS,t}$:

$$y^{SCG}_{IRS,t} = y^{DIV}_{M,t} \frac{SCG_{IRS,t}}{D_{IRS,t}}, \tag{6}$$

$$y^{LCG}_{IRS,t} = y^{DIV}_{M,t} \frac{LCG_{IRS,t}}{D_{IRS,t}}. \tag{7}$$

I assume that investors anticipate to realize a fixed proportion of capital gains out of the total expected returns net of expected dividend payments. Thus, investors expect to realize larger capital gains for stock portfolios that are anticipated to pay smaller dividend yields. The average market return (either S&P Composite Index or CRSP value-weighted index) is given by $\overline{r}_M$.[24] The time-series of capital gains yields used to compute the tax yield in equation (2) or equity portfolio k are assumed to be as follows:

$$y^{SCG}_{k,t} = \overline{y}^{SCG}_{IRS} \frac{\overline{r}_M - y^{DIV}_{k,t}}{\overline{r}_M - \overline{y}^{DIV}_M} = \eta^{SCG}_0 - \eta^{SCG}_1 y^{DIV}_{k,t}. \tag{8}$$

$$y^{LCG}_{k,t} = \overline{y}^{LCG}_{IRS} \frac{\overline{r}_M - y^{DIV}_{k,t}}{\overline{r}_M - \overline{y}^{DIV}_M} = \eta^{LCG}_0 - \eta^{LCG}_1 y^{DIV}_{k,t}. \tag{9}$$

This specification results in average expected capital gains realizations that fit the average realization behavior over the whole sample period according to the IRS. In the empirical section, I relate abnormal portfolio returns to the tax yield coefficient κ.

[24]To avoid a potential spurious correlation between the tax yield and the portfolio return in Section IV, I adjust the tax yield coefficient by using the average market return $\overline{r}_M$ instead of the average return of a specific portfolio $\overline{r}_k$. As demonstrated in a robustness test, this assumption results in more conservative estimates of the tax capitalization coefficient.

E Effective Tax Rate

Based on these assumptions, it is possible to derive effective tax yields for different portfolios according to equation (2). The tax yield depends primarily on the dividend yield and the dividend and capital gains tax rates:

$$\begin{aligned} \kappa_{k,t} &= \tau_t^{DIV} y_{k,t}^{DIV} + \tau_t^{SCG} y_{k,t}^{SCG} + \tau_t^{LCG} y_{k,t}^{LCG} \\ &= y_{k,t}^{DIV} \left(\tau_t^{DIV} - \eta_1^{SCG} \tau_t^{SCG} - \eta_1^{LCG} \tau_t^{LCG} \right) + \eta_0^{SCG} \tau_t^{SCG} + \eta_0^{LCG} \tau_t^{LCG}. \end{aligned} \tag{10}$$

To study the main determinants of the effective tax yield it is insightful to regress the tax yield on its main components. Most of the variation in the tax yield is explained by the average marginal tax rate on dividends for taxable investors (the R-squared of a univariate regression of the tax yield on the dividend tax rate is 0.606). The dividend yield and the proportion of equity securities held in taxable accounts are also important but play a secondary role (their univariate R-squares are 0.264 and 0.178). On the other hand, the average marginal tax rate on long-term capital gains does not have significant explanatory power for the tax yield.

F Taxable Dividends

For the cross-sectional results using CRSP data, I compute dividend yields using only taxable dividends, which have the following CRSP distribution codes: 1200, 1202, 1212, 1218, 1222, 1228, 1232, 1231, 1238, 1239, 1242, 1248, 1252, 1258, 1262, 1268, 1272, 1278, 1279, 1282, 1292, 1312, 1318, 1332, 1338, 1342, 1348, 1352, 1362, 1368, 1372, 1378, 1412, 1418, 1438, 1712, 1718, 1772, 1812, 1818, 1872, and 1999.

G Macroeconomic Data

The S&P Composite Index, the corresponding dividend and earnings variables, and the consumer price index series between 1871 and 2006 used in Section III are taken from Robert Shiller's webpage and correspond to the December values from the monthly data series. The interest rate is based on Shiller's annual data and captures the annual compounded yield of 6-month Commercial Paper rates until August 1997 and the 6-month Certificate of Deposit rate after that.[25] Shiller's website only lists interest rates until 2004. The data for 2005 and 2006 are computed using the Federal Reserve Board's 6-month Certificates of Deposit (secondary market) by compounding the rates in January and December.[26] The rate of inflation is based on the relative changes in the consumer price index and the S&P Index return is the total return of the index including dividend payments.

The equity Q is obtained from Wright (2004) between 1900 and 1951 and from the Federal Reserve Board's Flow of Funds Accounts between 1952 and 2006. The equity Q based on the Flow of Funds is defined as the ratio between the market value of equity outstanding of nonfinancial corporate business (FL103164003) and the net worth

[25] See http://www.econ.yale.edu/~shiller/data.htm for the data sources.

[26] The data are obtained from http://www.federalreserve.gov/releases/h15/data.htm.

at market value of nonfarm nonfinancial corporate business (FL102090005). It uses the values for the fourth quarter in each year since 1952. The correlation between the values in Wright and the Flow of Funds computations equals 99.71 percent over the overlapping period between 1952 and 2002.

The nominal output growth rate is computed using the growth rate in the GNP from Mitchell (1983) prior to 1928 and the growth rate in the GDP from the BEA (Table 1.1 Line 1) for the remaining years. The U.S. population prior to 1940 is taken from Dodd (1993) and after 1939 from the BEA (Table 8.7 Line 16). The per capita growth rate is computed as the relative change in the nominal output divided by the U.S. population.[27]

The corporate quality and term spreads are computed based on data on the averages of the monthly yields of corporate securities obtained from the Federal Reserve over the period between 1919-2006.[28] The quality spread is defined as the difference between the yields on Baa and Aaa corporate bonds. The term spread is defined as the difference between the yields on Aaa corporate bonds and one-year interest rate on commercial paper by Shiller as described above.

Stock participation is defined as the proportion of households that obtain dividend payments according to IRS data. It is computed as the ratio between the total number of tax returns with dividends according to the annual Statistics of Income of the IRS divided by the number of households in the U.S., which is obtained from the Census. Prior to 1947, the number of households is only reported every ten years and is linearly interpolated between reporting dates.

Government expenditures to GDP prior to 1929 are based on the Historical Statistics of the United States Colonial Times to 1970 Part I, 232 Series F 216-225 and after 1928 on the Bureau of Economic Analysis' Current Government Expenditures (Table 3.1) Divided by Gross Domestic Product (Table 1.1.5).

The standardized M&A activity is defined as the aggregate number of Mergers and Acquisitions divided by the number of companies according to the Statistics of Income of the IRS. Data until 1988 correspond to the standardized spliced time series of Town (1992). Subsequent data are computed by dividing the aggregate number of M&A's from Mergerstat by the number of companies according to the IRS' Statistics of Income. Following Town (1992) this fraction of M&A transactions is further standardized by subtracting the mean and dividing by the standard deviation of the time-series.[29]

The top corporation tax rate is obtained from Pechman (1987) until 1985 and the IRS for subsequent years.

[27]Data from the BEA can be accessed at http://www.bea.gov and the party of the president can be found on http://www.whitehouse.gov/history/presidents/.

[28]The data are available at http://www.federalreserve.gov/releases/h15/data.htm.

[29]The Town data are available at http://fmwww.bc.edu/ec-p/data/micro/town.dta and the number of M&A from Mergerstat are available at http://www.mergerstat.com/new/indexnew.asp.

Figure 1: Statutory Federal Marginal Dividend and Capital Gains Tax Rates
The marginal dividend and long-term capital gains tax rates are depicted over the period from 1913 to 2006 for three different real income levels. Two curves correspond to the marginal income tax rates for households with real income levels of $100,000 and $250,000 expressed in 2006 consumer prices. The third curve corresponds to the marginal income tax rate for the top income tax bracket.

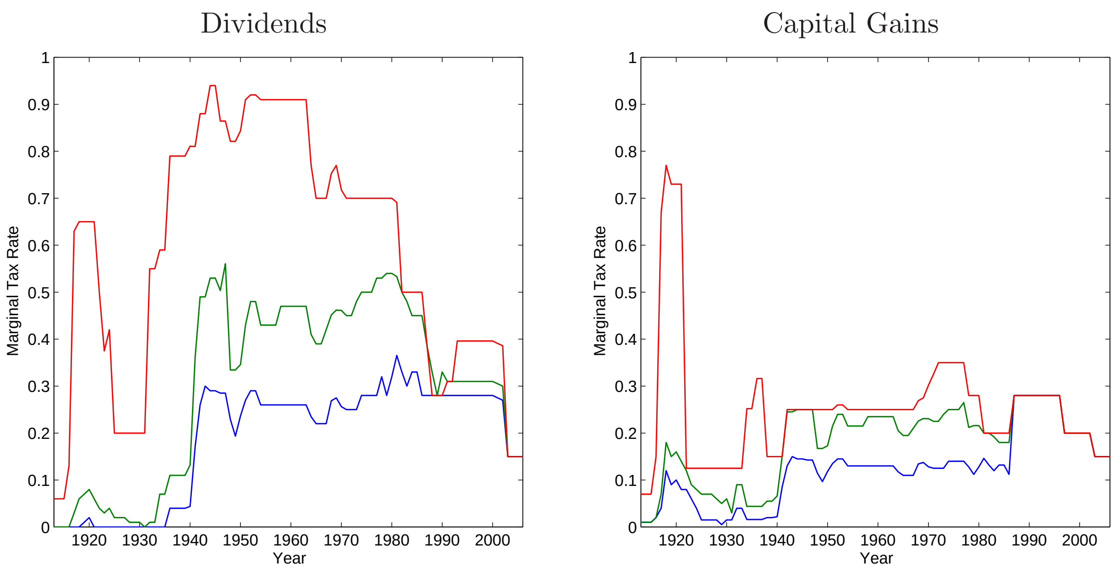


Figure 2: Average Marginal Investment Income Tax Rates
The dollar-weighted average marginal tax rates on dividend income and long-term capital gains are depicted between 1913 and 2006. The tax rates include taxes imposed by state and local governments.

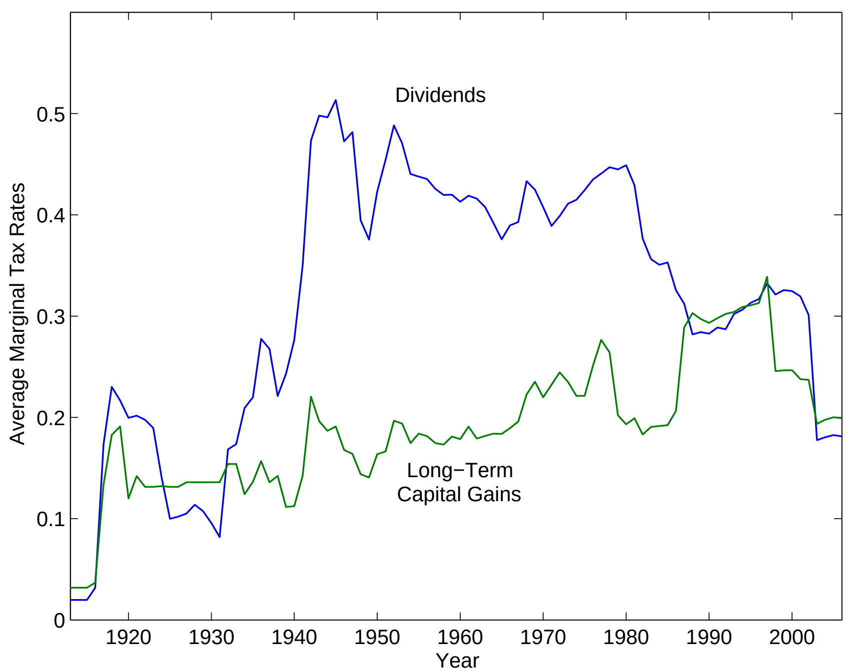


Figure 3: Distribution of Effective Tax Yields
The effective tax yields are depicted for three stock portfolios. The middle curve corresponds to the effective tax yield of the Standard & Poor's Composite Index between 1913 and 2006. The lower curve corresponds to the portfolio that includes all the stocks that did not pay any dividends in the previous year, and the upper curve corresponds to the 20 percent of dividend-paying stocks with the highest dividend yields during the prior year according to CRSP. The effective tax yield is defined as $\kappa_{k,t} = \tau_t^{DIV} y_{k,t}^{DIV} + \tau_t^{SCG} y_{k,t}^{SCG} + \tau_t^{LCG} y_{k,t}^{LCG}$, where τ_t^{DIV}, τ_t^{SCG}, and τ_t^{LCG} are the average marginal tax rates on dividends and short- and long-term capital gains, and $y_{k,t}^{DIV}$, $y_{k,t}^{SCG}$, and $y_{k,t}^{LCG}$ are the dividend yields, and the long- and short-term capital gains yields.

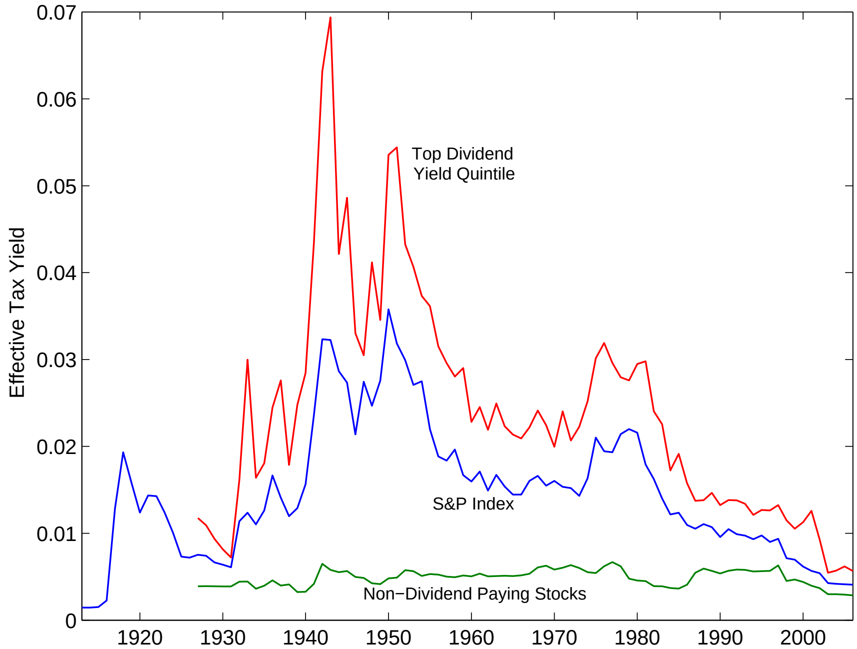


Figure 4: Factor Loadings for Dividend and Non-Dividend Portfolios
The factor loadings for non-dividend paying stocks and for dividend-paying stocks with the 20 percent highest dividend yields in the previous year are summarized over the period from 1932 to 2006. The factor loadings of the Fama-French-Carhart model are computed on a rolling basis using 60 months of prior return data. The portfolios are value-weighted.

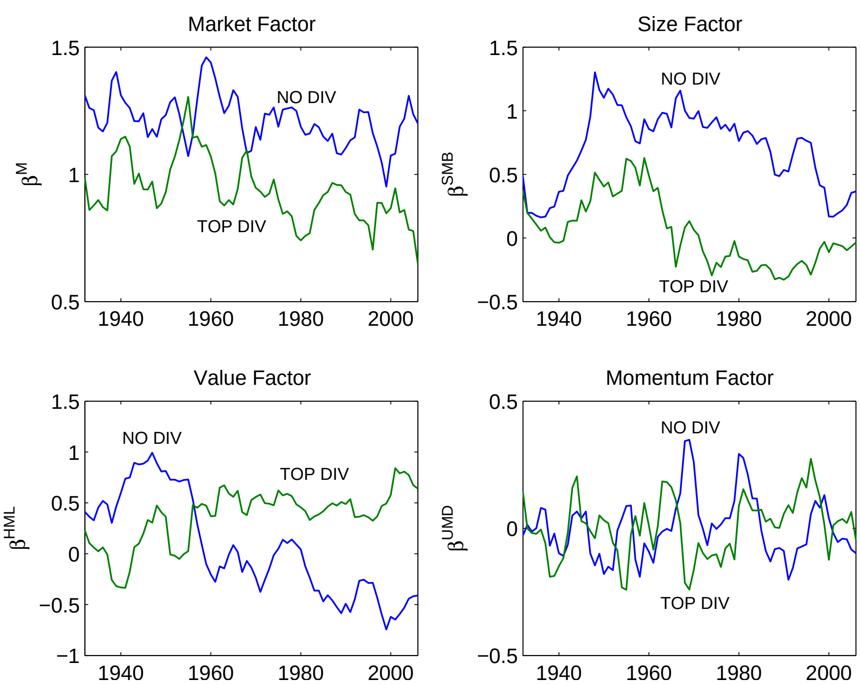


Figure 5: Cross-Sectional Relationship Between Abnormal Returns and Effective Tax Rates

The figure relates average tax yields to the performance of 30 value-weighted portfolios formed according to six dividend yield groups and five market capitalization groups between 1927-2006. The abnormal returns are computed based on the CAPM, the Fama-French, or the Fama-French-Carhart models.

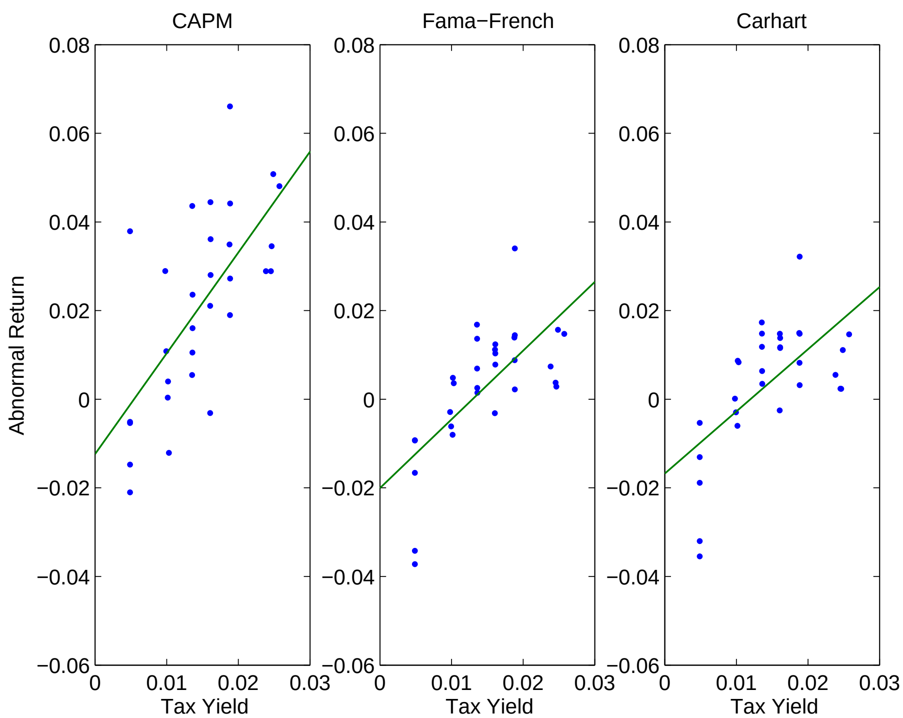
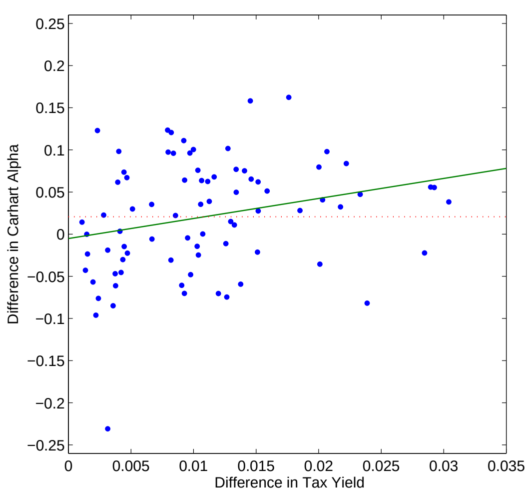


Figure 6: Time-Series Relationship Between Return Differentials and Tax Differentials
The figures relate the annual tax yield differentials to the abnormal performance differentials between stocks paying dividends and stocks paying no dividends. The horizontal axis depicts the difference between the tax yields and the vertical axis depicts the difference between the abnormal Fama-French-Carhart returns of the two portfolios.

Panel A:
Dividend Paying Stocks vs.
Non-Dividend Paying Stocks



Panel B:
Top-Dividend Quintile vs.
Non-Dividend Paying Stocks

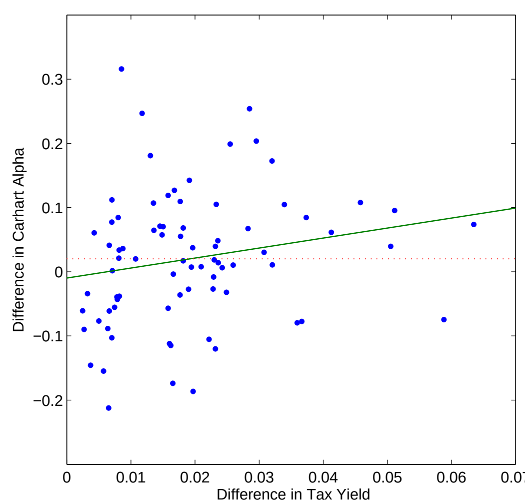


Table 1: Summary Statistics of Macroeconomic Variables

This table summarizes the moments of the various tax rates and macroeconomic variables between 1913-2006 (or over the sample period the data are available). The fifth column shows the correlation between the corresponding variable and the effective tax rate.

		Mean	Std. Dev.	Min	Max	Corr
(1)	Effective Tax Yield	0.015	0.008	0.001	0.036	1
(2)	Average Tax on Dividends	0.313	0.129	0.020	0.513	0.778
(3)	Average Tax on Short Capital Gains	0.326	0.133	0.020	0.519	0.680
(4)	Average Tax on Long Capital Gains	0.190	0.063	0.032	0.339	0.066
(5)	Tax on Dividends ($100,000)	0.188	0.123	0	0.365	0.422
(6)	Tax on Dividends ($250,000)	0.299	0.189	0	0.561	0.617
(7)	Tax on Dividends (Maximum)	0.582	0.265	0.06	0.94	0.845
(8)	Proportion of Taxable Investors	0.805	0.149	0.456	0.922	0.421
(9)	Dividend Yield	0.045	0.017	0.011	0.089	0.514
(10)	Equity Q	0.673	0.312	0.266	1.840	−0.514
(11)	Price-Earnings Ratio (Divided by 100)	0.144	0.071	0.058	0.539	−0.406
(12)	S&P Index Return	0.118	0.189	−0.403	0.526	0.190
(13)	Interest Rate	0.047	0.032	0.005	0.176	−0.186
(14)	Inflation Rate	0.034	0.051	−0.108	0.204	0.244
(15)	Per Capita Growth Rate	0.054	0.081	−0.251	0.264	0.307
(16)	Corporate Bond Quality Spread	0.012	0.007	0.004	0.042	−0.202
(17)	Corporate Bond Term Spread	0.012	0.015	−0.035	0.046	−0.142
(18)	Stock Participation	0.166	0.080	0.078	0.326	−0.823
(19)	Government Expenditures to Output	0.225	0.093	0.054	0.353	0.161
(20)	Standardized M&A Activity	0.103	0.877	−1.373	2.835	−0.303
(21)	Corporate Tax Rate	0.339	0.160	0.01	0.528	0.517
(22)	Democratic President	0.511	0.503	0	1	0.253

Table 2: Taxes and Valuation Ratios

This table summarizes the coefficients of the following regression: $val_t = \alpha_0 + \alpha_1 \kappa_t + \alpha_2 rf_t + \alpha_3 \pi_t + \alpha_4 g_t + \alpha_5 t + \epsilon_t$, where val_t is either the equity Q or the price of the Standard & Poor's Composite Index at the end of year divided by the earnings of the underlying stocks in the following year; κ_t is the effective tax yield; rf_t is the nominal risk-free interest rate; π_t is the inflation rate; g_t is the per-capita real growth rate of aggregate output; and t is a linear time trend. The Newey-West standard errors are summarized in parentheses and use a four-year lag. The significance levels are abbreviated with asterisks: One, two, and three asterisks denote significance at the 10, 5, and 1 percent level, respectively.

	Equity Q		Price-Earnings Ratio (Divided by 100)	
Tax Yield	-20.876^{***}	-20.727^{***}	-3.754^{**}	-3.154^{***}
	(5.158)	(3.960)	(1.585)	(1.162)
Interest Rate		-2.639^{**}		-0.324
		(1.136)		(0.214)
Inflation Rate		-1.051^{*}		-0.252^{**}
		(0.560)		(0.098)
Growth Rate		0.584		-0.017
		(0.385)		(0.052)
Time Trend		0.005^{***}		0.001^{**}
		(0.002)		(0.000)
Constant	0.980^{***}	0.855^{***}	0.200^{***}	0.166^{***}
	(0.118)	(0.072)	(0.033)	(0.022)
Obs.	94	94	93	93
R^2	0.264	0.498	0.165	0.342

Table 3: Taxes and Valuation Ratios: Subperiods

This table summarizes the coefficients of the following regression: $val_t = \alpha_0 + \alpha_1\kappa_t + \alpha_2 rf_t + \alpha_3\pi_t + \alpha_4 g_t + \alpha_5 t + \epsilon_t$, where val_t is either the equity Q or the price of the Standard & Poor's Composite Index at the end of year divided by the earnings of the underlying stocks in the following year; κ_t is the effective tax yield; rf_t is the nominal risk-free interest rate; π_t is the inflation rate; g_t is the per-capita real growth rate of aggregate output; and t is a linear time trend. The Newey-West standard errors are summarized in parentheses and use a four-year lag. The significance levels are abbreviated with asterisks: One, two, and three asterisks denote significance at the 10, 5, and 1 percent level, respectively.

	Equity Q		Price-Earnings Ratio (Divided by 100)	
	1913-1959	1960-2006	1913-1959	1960-2005
Tax Yield	-21.612^{***}	-16.598	-2.313^{*}	-8.736^{**}
	(4.513)	(16.205)	(1.249)	(4.299)
Interest Rate	-0.693	-2.517	0.448	0.111
	(2.907)	(2.031)	(0.493)	(0.494)
Inflation Rate	-0.702	-2.201	-0.197^{**}	-0.182
	(0.454)	(2.723)	(0.083)	(0.487)
Growth Rate	0.618	-1.343	0.010	-0.693^{***}
	(0.417)	(1.416)	(0.063)	(0.239)
Time Trend	0.008^{**}	0.002	0.002^{**}	-0.001
	(0.004)	(0.007)	(0.001)	(0.001)
Constant	0.742^{***}	1.183^{**}	0.119^{***}	0.360^{***}
	(0.109)	(0.586)	(0.034)	(0.089)
Obs.	47	47	47	46
R^2	0.407	0.461	0.268	0.394

Table 4: Taxes and Valuation Ratios: Additional Control Variables
This table summarizes the coefficients of the following regression: $val_t = \alpha_0 + \alpha_1\kappa_t + \alpha_2 rf_t + \alpha_3\pi_t + \alpha_4 g_t + \alpha_5 t + \alpha_6 x_t + \epsilon_t$, where val_t is either the equity Q or the price of the Standard & Poor's Composite Index at the end of year divided by the earnings of the underlying stocks in the following year; κ_t is tax yield; rf_t is the risk-free interest rate; π_t is the inflation rate; g_t is the per-capita real growth rate of aggregate output; t is a linear time trend; and x are additional control variables, such as the quality spread between long-term yields on corporate bonds with ratings of Baa and Aaa, the term spread between the yields on long-term corporate bonds with a rating of Aaa and the short-term corporate yield, the percentage of households that own dividend paying stocks; the current government expenditures divided by aggregate output, the standardized measure of M&A activity, the top marginal corporate tax rate, and an indicator variable for whether the president is a Democrat. The significance levels are abbreviated with asterisks: One, two, and three asterisks denote significance at the 10, 5, and 1 percent level, respectively.

Panel A: Equity Q

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Tax Yield	-24.448^{***}	-24.350^{***}	-27.903^{***}	-18.930^{***}	-18.178^{***}	-23.763^{***}	-21.784^{***}
	(4.297)	(5.687)	(8.142)	(3.349)	(3.746)	(4.645)	(3.606)
Interest Rate	-1.779^{*}	-6.334^{***}	-1.571	-2.626^{**}	-2.972^{**}	-2.741^{**}	-1.485
	(0.966)	(1.887)	(1.531)	(1.147)	(1.185)	(1.066)	(1.056)
Inflation Rate	-1.354^{***}	-1.160^{**}	-1.389^{*}	-1.061^{*}	-0.779	-0.994^{*}	-1.681
	(0.505)	(0.548)	(0.765)	(0.574)	(0.498)	(0.567)	(0.607)
Growth Rate	0.478^{*}	0.809^{**}	0.851	0.572	0.549	0.589	0.498
	(0.261)	(0.330)	(0.788)	(0.377)	(0.331)	(0.380)	(0.367)
Quality Spread	-17.366^{***}						
	(4.256)						
Term Spread		-10.305^{***}					
		(3.881)					
Stock Participation			3.027				
			(2.363)				
Government Expenditures				-0.512			
				(1.126)			
M&A Activity					0.092^{**}		
					(0.040)		
Corporate Tax						0.226	
						(0.424)	
Democratic President							0.209^{**}
							(0.087)
Time Trend	0.003	0.008^{**}	-0.012	0.007	0.005^{***}	0.004	0.006^{***}
	(0.002)	(0.003)	(0.010)	(0.004)	(0.002)	(0.003)	(0.002)
Constant	1.214^{***}	1.049^{***}	1.475^{***}	0.868^{***}	0.822^{***}	0.869^{***}	0.717^{***}
	(0.123)	(0.143)	(0.406)	(0.090)	(0.068)	(0.067)	(0.107)
Time Period	1919-2006	1919-2006	1940-2006	1913-2006	1913-2006	1913-2006	1913-2006
Obs.	88	88	61	94	94	94	94
R^2	0.579	0.585	0.574	0.500	0.557	0.501	0.581

Panel B: Price-Earnings Ratio (Divided by 100)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Tax Yield	-4.242^{***}	-4.774^{***}	-6.719^{***}	-2.684^{**}	-2.572^{***}	-2.940^{**}	-3.262^{***}
	(1.356)	(1.459)	(1.483)	(1.118)	(0.936)	(1.242)	(1.227)
Interest Rate	-0.268	-1.065^{***}	0.108	-0.322	-0.417	-0.317	-0.187
	(0.194)	(0.361)	(0.340)	(0.216)	(0.235)	(0.214)	(0.219)
Inflation Rate	-0.246^{**}	-0.244^{*}	-0.316^{**}	-0.255^{**}	-0.184^{*}	-0.256^{**}	-0.326^{***}
	(0.121)	(0.123)	(0.149)	(0.099)	(0.109)	(0.100)	(0.106)
Growth Rate	-0.030	0.021	0.022	-0.020	-0.024	-0.017	-0.028
	(0.069)	(0.069)	(0.176)	(0.055)	(0.065)	(0.051)	(0.054)
Quality Spread	-1.411						
	(0.853)						
Term Spread		-2.009^{***}					
		(0.762)					
Stock Participation			0.942				
			(0.639)				
Government Expenditures				-0.136			
				(0.355)			
M&A Activity					0.023^{**}		
					(0.011)		
Corporate Tax						-0.016	
						(0.086)	
Democratic President							0.024
							(0.020)
Time Trend	0.001	0.002^{**}	-0.004	0.002	0.001^{***}	0.001	0.001^{**}
	(0.000)	(0.001)	(0.003)	(0.001)	(0.000)	(0.001)	(0.00)
Constant	0.218^{***}	0.228^{***}	0.375^{***}	0.170^{***}	0.158^{***}	0.165^{***}	0.150^{***}
	(0.036)	(0.032)	(0.090)	(0.025)	(0.019)	(0.022)	(0.024)
Time Period	1919-2005	1919-2005	1946-2005	1913-2005	1913-2005	1913-2005	1913-2005
Obs.	87	87	60	93	93	93	93
R^2	0.358	0.415	0.451	0.346	0.415	0.343	0.365

Table 5: Taxes and Valuation Ratios: Robustness Tests

This table summarizes the coefficients of the following regression: $val_t = \alpha_0 + \alpha_1\kappa_t + \alpha_2 rf_t + \alpha_3\pi_t + \alpha_4 g_t \alpha_5 t + \epsilon_t$, where val_t is either the equity Q or the price of the Standard & Poor's Composite Index at the end of year divided by the earnings of the underlying stocks in the following year; κ_t is tax yield; rf_t is the risk-free interest rate; π_t is the inflation rate; g_t is the per-capita real growth rate of aggregate output; and t is a linear time trend. The IV estimation uses the current government expenditures as an instrument for the effective tax rate. The other specifications use different measures of the effective tax rate on equity securities. The Newey-West standard errors are summarized in parentheses and use a four-year lag. The significance levels are abbreviated with asterisks: One, two, and three asterisks denote significance at the 10, 5, and 1 percent level, respectively.

Panel A: Equity Q

	IV	All	Const.	No	Full	Statutory Tax Rates		
		Taxed	Dist.	Gains	Gains	\$100K	\$250K	Max
Tax Yield	−23.315***	−21.022***	−17.552***	−22.608***	−14.467***	−26.267***	−15.613***	−10.358***
	(7.337)	(4.015)	(6.603)	(3.944)	(4.231)	(6.258)	(3.658)	(1.766)
Interest Rate	−2.762**	−2.175**	−2.322*	−2.657**	−2.470*	−2.052*	−2.160*	−3.048***
	(1.217)	(1.085)	(1.332)	(1.028)	(1.347)	(1.162)	(1.152)	(1.017)
Inflation Rate	−0.989	−0.992*	−1.195*	−1.016*	−1.181*	−1.047*	−0.956	−0.901
	(0.839)	(0.544)	(0.684)	(0.521)	(0.652)	(0.630)	(0.627)	(0.562)
Growth Rate	0.633	0.631	0.373	0.624	0.457	0.431	0.462	0.485
	(0.493)	(0.373)	(0.476)	(0.372)	(0.425)	(0.407)	(0.417)	(0.420)
Time Trend	0.005***	0.007***	0.006**	0.005***	0.007***	0.008***	0.007***	0.003**
	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Constant	0.897***	0.841***	0.753***	0.845***	0.827***	0.623***	0.671***	0.950***
	(0.145)	(0.069)	(0.097)	(0.095)	(0.095)	(0.073)	(0.071)	(0.073)
Obs.	94	94	94	94	94	94	94	94
R^2	0.494	0.528	0.378	0.530	0.410	0.467	0.478	0.499

Panel B: Price-Earnings Ratio (Divided by 100)

	IV	All	Const.	No	Full	Statutory Tax Rates		
		Taxed	Dist.	Gains	Gains	\$100K	\$250K	Max
Tax Yield	−3.859**	−3.345***	−2.446*	−3.462***	−2.145*	−4.589***	−2.644***	−1.264**
	(1.760)	(1.194)	(1.426)	(1.131)	(1.010)	(1.716)	(0.990)	(0.543)
Interest Rate	−0.359	−0.259	−0.267	−0.328*	−0.296	−0.246	−0.261	−0.343
	(0.286)	(0.204)	(0.245)	(0.196)	(0.249)	(0.210)	(0.210)	(0.225)
Inflation Rate	−0.236**	−0.240**	−0.279**	−0.246***	−0.274**	−0.241**	−0.228***	−0.242**
	(0.211)	(0.098)	(0.108)	(0.093)	(0.109)	(0.101)	(0.097)	(0.108)
Growth Rate	−0.004	−0.007	−0.051	−0.011	−0.037	−0.035	−0.031	−0.041
	(0.126)	(0.053)	(0.050)	(0.052)	(0.052)	(0.056)	(0.054)	(0.048)
Time Trend	0.001***	0.001***	0.001**	0.001**	0.001**	0.002***	0.001***	0.001*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)
Constant	0.178***	0.166***	0.148***	0.165***	0.161***	0.133***	0.141***	0.168***
	(0.034)	(0.021)	(0.020)	(0.020)	(0.024)	(0.013)	(0.014)	(0.025)
Obs.	93	93	93	93	93	93	93	93
R^2	0.338	0.366	0.281	0.359	0.299	0.355	0.355	0.308

Table 6: Dividend-Yield Portfolios
This table summarizes the dividend yields and the abnormal returns for portfolios formed according to the initial dividend yields over the period from 1927 to 2006. The returns are expressed in percent per month and standard errors are summarized in parentheses. The significance levels are abbreviated with asterisks: One, two, and three asterisks denote significance at the 10, 5, and 1 percent level, respectively.

	Annual Dividend Yields		Monthly Value-Weighted Alphas		
	Prior Year	Subsequent Year	CAPM	Fama-French	Fama-French-Carhart
No Dividend Portfolio	0	0.52	−0.16	−0.17***	−0.16**
			(0.10)	(0.06)	(0.07)
Dividend Portfolio	4.38	4.27	0.06***	0.04***	0.05***
			(0.02)	(0.01)	(0.01)
Dividend Portfolio Minus No Dividend Portfolio	−4.38	−3.74***	0.22*	0.21***	0.21***
		(0.03)	(0.10)	(0.06)	(0.07)
No Dividend Portfolio	0	0.52	−0.16	−0.17***	−0.16**
			(0.10)	(0.06)	(0.07)
Lowest Yield Quintile	2.00	2.30	−0.07	0.02	0.06
			(0.05)	(0.05)	(0.05)
Quintile 2	3.36	3.47	0.06	0.13***	0.14***
			(0.05)	(0.04)	(0.04)
Quintile 3	4.41	4.35	0.04	0.00	0.01
			(0.05)	(0.05)	(0.05)
Quintile 4	5.55	5.23	0.20***	0.09*	0.09*
			(0.05)	(0.05)	(0.05)
Highest Yield Quintile	7.89	6.73	0.26***	0.07	0.04
			(0.07)	(0.08)	(0.06)
Highest Yield Quintile Minus No Dividend Portfolio	−7.89	−6.20***	0.42***	0.24***	0.21**
		(0.04)	(0.14)	(0.09)	(0.09)

Table 7: Tax Capitalization Regressions

This table summarizes the tax capitalization coefficient γ of the following regression: $r_{k,t} - r_{f,t} = \alpha + \sum_{k,t,f} \beta_{k,t,f} fr_{t,f} + \gamma \kappa_{k,t} + \epsilon_{k,t}$, where $r_{k,t} - rf_{k,t}$ is the excess return above the risk-free rate for portfolio k at time t; $\beta_{k,t,f}$ is the factor loading for the f factor at time t for portfolio k and $fr_{k,t,f}$ is the corresponding factor return; and $\kappa_{k,t}$ is the tax yield of portfolio k at time t. Three different portfolio formation criteria are used: (1) two portfolios based on one portfolio including all non-dividend paying stocks and one portfolio including dividend paying stocks; (2) six portfolios based on one portfolio including all non-dividend paying stocks and dividend-yield quintile portfolios including dividend paying stocks; and (3) 30 portfolios based on six dividend yield groups and five size groups. The stocks in the different portfolios are value-weighted. Abnormal returns are computed using the CAPM, the Fama-French, and the Carhart factors by allowing factor loadings to differ in each 5-year period for each of the portfolios using data over the period from 1927 to 2006. The standard errors take into account clustering by time period and are summarized in parentheses. The significance levels are abbreviated with asterisks: One, two, and three asterisks denote significance at the 10, 5, and 1 percent level, respectively.

	CAPM	Fama-French	Fama-French-Carhart
2 Dividend Yield Portfolios	1.05*	1.05***	0.99***
	(0.62)	(0.38)	(0.39)
6 Dividend Yield Portfolios	0.90***	0.57***	0.50**
	(0.29)	(0.21)	(0.22)
30 Dividend Yield and Size Portfolios	0.88**	0.77***	0.73***
	(0.42)	(0.19)	(0.20)

Table 8: Tax Capitalization Regressions: Subperiod Evidence

This table summarizes the tax capitalization coefficient γ of the following regression: $r_{k,t} - r_{f,t} = \alpha + \sum_{k,t,f} \beta_{k,t,f} fr_{t,f} + \gamma \kappa_{k,t} + \epsilon_{k,t}$, where $r_{k,t} - rf_{k,t}$ is the excess return above the risk-free rate for portfolio k at time t; $\beta_{k,t,f}$ is the factor loading for the f factor at time t for portfolio k and $fr_{k,t,f}$ is the corresponding factor return; and $\kappa_{k,t}$ is the tax yield of portfolio k at time t. The estimations are based on 30 portfolios using six dividend yield groups and five size groups. The stocks in the different portfolios are value-weighted. Abnormal returns are computed using the CAPM, the Fama-French, and the Carhart factors by allowing factor loadings to differ in each 5-year period for each of the portfolios using data over the period from 1927 to 2006. The standard errors take into account clustering by time period and are summarized in parentheses. The significance levels are abbreviated with asterisks: One, two, and three asterisks denote significance at the 10, 5, and 1 percent level, respectively.

	CAPM	Fama-French	Fama-French-Carhart
1927-1949	1.14	0.76**	0.76**
	(0.77)	(0.33)	(0.34)
1950-1969	−0.15	0.88***	0.73**
	(0.64)	(0.32)	(0.33)
1970-1989	4.80***	1.32*	1.72***
	(1.17)	(0.70)	(0.65)
1990-2006	3.62	2.05	1.65
	(2.72)	(1.64)	(1.68)

Table 9: Tax Capitalization Regressions: Different Measures of Tax Burden

This table summarizes the tax capitalization coefficient γ of the following regression: $r_{k,t} - r_{f,t} = \alpha + \sum_{k,t,f} \beta_{k,t,f} fr_{t,f} + \gamma\kappa_{k,t} + \epsilon_{k,t}$, where $r_{k,t} - rf_{k,t}$ is the excess return above the risk-free rate for portfolio k at time t; $\beta_{k,t,f}$ is the factor loading for the f factor at time t for portfolio k and $fr_{k,t,f}$ is the corresponding factor return; and $\kappa_{k,t}$ is the tax yield of portfolio k at time t. The table summarizes 10 cases with different definitions of the effective tax rate and one case with time-fixed effects. The estimations are based on 30 portfolios using six dividend yield groups and five size groups. The stocks in the different portfolios are value-weighted. Abnormal returns are computed using the CAPM, the Fama-French, and the Carhart factors by allowing factor loadings to differ in each 5-year period for each portfolio using data over the period from 1927 to 2006. The standard errors take into account clustering by time period for the first 10 rows and clustering by porfolio number for row (11) and are summarized in parentheses. The significance levels are abbreviated with asterisks: One, two, and three asterisks denote significance at the 10, 5, and 1 percent level, respectively.

		CAPM	Fama-French	Fama-French-Carhart
(1)	Base Case	0.88**	0.77***	0.73***
		(0.42)	(0.19)	(0.20)
(2)	Fitted Dividend Yield	0.91*	0.79***	0.74***
		(0.55)	(0.24)	(0.24)
(3)	Taxable Accounts Only	1.16***	0.83***	0.79***
		(0.40)	(0.19)	(0.19)
(4)	Different Mean Returns	0.97**	0.76***	0.71***
		(0.41)	(0.19)	(0.19)
(5)	Lag Tax Yield	0.77*	0.84***	0.80***
		(0.41)	(0.20)	(0.20)
(6)	No Capital Gains Taxed	0.85**	0.77***	0.73***
		(0.37)	(0.18)	(0.18)
(7)	No Capital Gains Deferral	0.73	0.53**	0.49*
		(0.60)	(0.25)	(0.26)
(8)	Statutory Tax Rate ($100,000)	1.48**	1.01***	0.91**
		(0.75)	(0.39)	(0.40)
(9)	Statutory Tax Rate ($250,000)	0.83**	0.59***	0.54***
		(0.43)	(0.21)	(0.21)
(10)	Statutory Tax Rate (Maximum)	0.29	0.33***	0.31***
		(0.19)	(0.11)	(0.11)
(11)	Time Fixed Effects	1.38***	1.77***	1.80***
		(0.50)	(0.34)	(0.38)